


Fire Based First Responder Service

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### Abstract

The problem is that the Waterbury Fire Department (WFD) has not evaluated the currently provided non-transport emergency medical services (EMS) at a first responder (FR) level using the existing fire service system. The purpose of the research is to determine this effectiveness of EMS delivery within the current system using evaluative research to answer questions regarding how WFD delivers EMS compared to standards and best practices for fire service first response systems, alternative systems used by comparable fire departments and the effect WFD. Using literature review, phone interviews and internet surveys, it was determined that the WFD delivers FR services appropriately but still lags behind other fire departments in level of certification for FR. Additionally strong community knowledge of how to perform cardiopulmonary resuscitation (CPR) and use automatic external defibrillator (AED) can improve survival rates in cardiac arrest victims. WFD should investigate improving cardiac survival rates, as rapid response by FR along with bystander CPR has been shown to improve survival. Recommendations include implementing a training program for WFD members to become EMT-B. WFD should form a committee to address out-of-hospital cardiac arrest survival rate by studying communities with high survival rates for out-of-hospital cardiac arrest. WFD should provide CPR and AED classes for the public to increase the survival rates for heart attack victims. Dispatch should start tracking the following times for the fire department crew arriving at patient, CPR started, AED shock delivered and ambulance crew arrival at patient. AED effects on out-of-hospital cardiac arrest survival rate should be studied by tracking shock advice; numbers of shocks delivered and return of pulse. Local medical control and private ambulance companies should be consulted to review current MPDS determinants codes response levels to determine if they are appropriate.

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## Fire Based First Responder Service

### **Introduction**

In 2009 WFD started FR service again after 27 years. During the next twelve months WFD has increased unit responses on average 200% (Firehouse (Version 7.5.60), 1993). The problem is the WFD has not evaluated the current provided non-transport EMS at a FR level using the existing fire service system. The purpose of this research is to determine the effectiveness of EMS delivery within the current system. This will be done using evaluative research to answer the following questions (a) what are the fire service standards for first response system, (b) what are the best practices for first response services, (c) what are alternative systems used by comparable fire departments providing FR services, (d) how does the WFD deliver first response, and (e) what effect has providing FR level EMS had on the WFD?

### **Background & Significance**

Waterbury is a former New England factory city that has lost its manufacturing base. Waterbury's population has stayed within one thousand plus or minus of 107,271 (U.S. Census Bureau, 2000, p. 1) for the past 30 years (TriData, 2004). Waterbury has a median household income of \$34,285 with 16% of persons falling below poverty level (U.S. Census Bureau, 2000, p. 1). A review of union contracts contains provision regarding WFD providing first response as early as 1967 continuing through 1983. During the 1960's there were no national standards of care for pre-hospital service, the closest was American National Red Cross first aid. Half of the nation's ambulance services were provided by morticians, mainly because they had the only vehicles that could carry litters. (National Academy of Sciences, 1966) At the time, EMS was not considered part of the WFD mission, as such WFD delivery of EMS never evolved as the

EMS field developed over the coming years. The loss of EMS was not seen as a reduction in service when it was negotiated away in the late eighties (J. McDermott & J. Delbuono, personal communication, October, 2010). Today the fire service has embraced EMS as the future proven by the fact that “an overwhelming number of first responders are fire department-based (89 percent)” (Board on Health Care Service et al., 2007, p. 56). Today most departments that have truly looked at what they actually provide for services will acknowledge they are EMS providers that happen to fight fires once in a while. WFD has followed suit. At the start of the twenty-first century the department had seen a reduction in staffing, zero growth in its budgets and the city experienced a state takeover because of budget short falls. During the state take over many contract benefits were reduced to help with the budget shortfall (J. McDermott, personal communication, August, 2010). EMS was seen as the most effective way to utilize current resources and to show a move forward, a greater demand for the fire department. July 1, 2009 WFD personnel were certified as FR for Waterbury by the state of Connecticut Department of Public Health and started responding to EMS incidents again. By looking at how the department delivers EMS this paper meets the United State Fire Administration (USFA) fifth goal by improving WFD business systems and processes.

### **Literature Review**

One of the issues WFD faced was the proper way to deliver first response services. There is little in the way of information on the quality of different EMS systems (Board on Health Care Service et al., 2007). This makes it hard to determine which system would work the best in Waterbury. First it should be established what is considered part of an EMS system,

EMS encompasses the initial stages of the emergency care continuum. It includes emergency calls to 9-1-1; dispatch of emergency personnel to the scene of an illness or

trauma; and triage, treatment...The speed and quality of emergency medical services are critical factors in a patient's ultimate outcome.” (Board on Health Care Service et al., 2007, p. 1)

Three standards were identified as applying to the fire service today, Insurance Services Office Public Protection Classifications Program (ISO), National Fire Protection Association (NFPA) Standards and Accreditation through the Commission on Fire Accreditation International (CFAI), which has changed its name to the Center for Public Safety Excellence (CPSE). Currently the City of Waterbury has an ISO rating of 2 given in 2001 (TriData, 2004, p. 233) however “The ISO system only focuses on fire suppression capabilities.” (Barbieri, III, 2009, p. 57), as such was not considered for this paper.

NFPA standards 1221 and 1710 were identified as being the relevant standards for fire based EMS. NFPA 1221 states that “Ninety-five percent of alarms received on emergency lines shall be answered within 15 seconds, and 99 percent of alarms shall be answered within 40 seconds.” (National Fire Protection Association [NFPA], 2010, para. 7.4.1). Once the call for service is answered, “Ninety percent of emergency alarm processing shall be completed within 60 seconds, and 99 percent of alarm processing shall be completed within 90 seconds” (NFPA, 2010, para. 7.4.2).

When the units are notified NFPA 1710 becomes the relevant standard defining response times and minimum training for EMS incidents. The NFPA defines First Responder (EMS) as being capable of providing an initial assessment, basic first-aid including CPR and AED capability (NFPA, 2010). This is the minimal level training for units responding to EMS incidents. The standard does not give staffing requirements for FR services, instead leaving it to the authority having jurisdiction (AHJ), “EMS staffing requirements shall be based on the

minimum levels needed to provide patient care and member safety” (NFPA, 2010, para. 5.3.3.2.2.1). Response times are defined as 60 second turnout time for EMS incidents and a “240 seconds or less travel time for the arrival of a unit with first responder ...at an emergency medical incident” (NFPA, 2010, para. 4.1.2.1).

A study by Upson & Notarianni (2010) reported issues with departments complying with NFPA 1221 & 1710, “To a large extent these benchmark times are based on qualitative data, experience, and assumptions and do not have a strong body of empirical data to justify them” (Upson & Notarianni, 2010, p. 1). When Upson and Notarianni looked into actual times they found departments were taking longer than the standard allowed for alarm handling and turnout times. The report found for EMS incidents the actual time for 90% of calls would be 84 seconds for alarm handling and 109 seconds for turnout (Upson & Notarianni, 2010, p. 1).

In these times of financial stress, the fire service is finding old arguments of run volume as justification for resources to be deficient; a better argument is the ability to deal with clearly identified risk (Ludwig, 2009). CPSE’s accreditation is the fire service’s answer; it involves “justification, cost benefit, and the ability to clearly bridge the investment to outcome” (Bruegman, 2009, p. 3). The International Association of Fire Chiefs (IAFC) also notes that the CFAI’s accreditation was an example of an equivalent standard to NFPA (IAFC, 2001, p. 13). It is worth noting that Mike Waters, ISO vice president – Risk Decision Services stated “ISO concluded that accredited firefighting agencies generally had better PPC [Public Protection Classification] gradings than unaccredited ones. ISO is revising its Fire Suppression Rating Schedule (FSRS) to give credit for maintaining CPSE accreditation” (Waters & Cobb, 2009, p. 7). Reviewing the CPSE website of fire departments currently accredited or going through the process found that the Hartford Fire Department was the only comparable fire department from



Connecticut going through accreditation (<http://www.publicsafetyexcellence.org/agency-accreditation/list-of-accredited-agencies.aspx>). Hartford Fire Department is currently listed by the CPSE as in applicant agencies status. CPSE does give some examples of time and performance standard for EMS response that an accredited department could use:

Priority	Category	Performance Goal for 90 percent of all calls
“4”	Non-Urgent	20 minutes from receipt of call to on scene
“3”	Urgent	15 minutes from receipt of call to on scene
“2”	Serious	10 minutes from receipt of call to on scene
“1”	Time-Critical	6 minutes from receipt of call to on scene

(Public Entity Risk Institute, 2003, p. 11)

To accomplish this prioritizing the system needs proper questioning of the caller to accurately send the appropriate response (Public Entity Risk Institute, 2003). Emergency Medical Dispatch (EMD) is one way this is done, “EMDs can readily distinguish levels of severity for emergency calls” (Clawson, Dernocoeur, & Rose, 2009, p. 1.6) and have been characterized in as “an ideal system” (NIST et al., 2010, p. 18). One of the more interesting concepts in EMD is that of Zero-Minute Response™, unless the FR finds the patient, it takes time to get FR to the patient (Clawson et al., 2009). “A properly-trained EMD can effectively eliminate this time gap for many situations. Willing bystanders can provide first aid via telephone instructions” (Clawson et al., 2009, p. 1.3). According to the IAFC (2001) with proper pre-arrival instructions the intention of NFPA 1710 can be met, “Pre-arrival interventions can be used to meet the intent of the standard. For example, if a dispatcher instructs a citizen who successfully administers the Heimlich maneuver to a victim, the clock stops.” (International Association of Fire Chiefs [IAFC], 2001, p. 12). Also Upson and Notarianni note that EMD

protocols could reduce alarm processing times (Upson & Notarianni, 2010). A study out of Canada looks into using Medical Priority Dispatch System® (MPDS) to optimize first response systems. The study looks into when a FR was required and the proper response level when needed (Craig, Verbeek, & Schwartz, 2010). The study found that it could be possible to reduce lights/siren response by 83% “by confining FFR response to 27 of 509 MPDS dispatch determinants....and 18,692 responses could be eliminated entirely” (Craig et al., 2010, p. 109).

The medical field has set clear benchmarks for delivery of treatment cardiovascular diseases (CVD). CVD can account for a small percentage of the overall EMS incidents, heart attacks may only account for as little as 1-2% of a fire department’s EMS incidents (Stout et al., 2000). The American Heart Association reports that 1 out of every 2.4 deaths is related to CVD. “CVD was about 60% of total mortality...CVD was listed as a primary or contributing cause on more than 1,406,000 death certificates” so while they account for a small percentage of incidents, CVD represents a large cause of loss of life.

Canadian Health Services Research Foundation (CHSRH) looked at what was the best practice for sudden out-of-hospital cardiac death. They found rapid defibrillation with CPR was the most effective treatment in the field (Stiell, 2005), while finding advanced life support intervention ineffective. These findings are in keeping with the second and third links in the American Heart Association chain of survival, “(2) early CPR, (3) early defibrillation...An EMS system where each of these links is strong is much more likely to bring back a patient from cardiac arrest” (Limmer & O’Keefe, 2009, p. 405). Ruygrok, Byyny, & Haukoos (2009) study also confirmed that survival mainly depends on the speed which CPR and defibrillation are delivered. It has been recommended that within 5 minutes of cardiac arrest defibrillation take place, the chance of survival decreases by 10% for each minute without defibrillation (Atkins et

al., 2001). Of note is the finding that the survival rate reaches the “30% point at 7 minutes” (Atkins et al., 2001, p. S64) At the same time an article in Scotland was printed in British Medical Journal concluding that “shorter response time was significantly associated with increased probability of receiving defibrillation and survival to discharge” (Pell, Sirel, Marsden, Ford, & Cobbe, 2001, p. 2). Eisenberg & White found that “The community in which an individual lives is the biggest factor determining whether survival or death follows out-of-hospital cardiac arrest” (2009, p. 258).

Many fire departments use a 24 hour shift to man fire stations which could “result in too many resources available during non-peak hours and not enough during peak periods” (Williams, 2006, p. 91) for EMS incidents. While this may be true for EMS incidents, the fire service as an all hazards agency should look at the ability to deal with potential risks and then set staffing to deal with those risks as the community wishes (Ludwig, 2009).

One of the benefits the fire service has over non-fire based EMS agencies is that fire stations tend to be evenly distributed through the area being protected. This gives fire based EMS an advantage when discussing response times advantages over non-fire based EMS (Board on Health Care Service et al., 2007). Analysis of 300 fire department determined that on average fire departments arrived on scene 3 minute before ambulances (NIST et al., 2010, p. 21). Pell et al. (2001) also recommended that the fire service be used due to having more stations that would allow for better response times.

One way non-fire based EMS has tried to address fixed station locations and changing call demand was with system status management (SSM) by Jack Stout. According to Bledsoe SMM has “no scientific evidence to support the practice” (Bledsoe, 2003, p. 158). Bledsoe continues in his article that SSM is a way to save the money of building fixed ambulance

stations. Which could be why, as Bledsoe points out, no major fire departments have moved to SSM. SSM at its simplest level is looking for patterns such as; when people are awake there are more calls, as noted by King and Sox (Dean, 2004, p. 117). One of the methods used in SSM is demand pattern analysis which was found to “reliably predict the timing of peaks and troughs in demand” (Brown, Lerner, Larmon, LeGassick, & Taigman, 2007, p. 201) but it “did underestimate call volume between 4% and 7% of the time” (Brown et al., 2007, p. 202).

EMS Field Experiments report released in the fall of 2010 as part of the Fire Fighter Safety and Deployment Study looks at what different combinations of staffing levels and certification levels mean to task completion. Overall the study found that larger crews reduce the possibility of injury and improved scene times by being able to simultaneously complete tasks (NIST et al., 2010, p. 11). The NIST et al. (2010) report found that sending four FR’s improved patient removal by 2.6 – 4.1 minutes faster than just sending an ambulance alone. A four person FR crew completed trauma tasks 3.4 minutes faster than just two FR. Administering oxygen, taking vitals, leg splinting and back-boarding was all completed quicker with crews of four FR (NIST et al., 2010). During a simulated witness arrest a FR crew of four was 1.4 minutes faster completing remaining task over two person crews. The study found that “to the extent that creating time efficiency is important for patient outcomes, including an ALS trained provider on an engine and using engine crew size of four are worth considering” (NIST et al., 2010, p. 12).

TriData has written a number of studies on fire departments across the nation, including WFD. TriData recommended that WFD assume the role of FRs because of “potential improvements to response times, more personnel to the scene and greater productivity for the fire department” (TriData, 2004, p. 152). Further reported was no response time standard for the private ambulances, which has caused reported frustration from police and fire in regards to the

private ambulance response time to scene. TriData (2004) recommended all FRs be trained to a minimum of Medical Response Technician (MRT) responding from fire station locations to give a quicker response time (TriData, 2004). The TriData (2006) report for Portland Fire and Rescue (PF&R) noted the staffing for FR was at least four personnel where they arrived first 68.5% of time making them a “vital link in the EMS delivery process” (TriData, 2006, p. 173). PF&R local medical control prefers this level of staffing so critical patients are treated quickly and there is evidence that a four person FR company assisting can decrease on-scene time for chest pain patients (TriData, 2006, p. 173).

One item that was dealt with in the PF&R study was that unit call volume of over 3,000 responses a year being too high a workload and should be addressed. This is in keeping with Dr. Becker’s 2009 presentation to the Public Safety Committee of the City of Mesa on call volume impact on Mesa firefighters. Dr. Becker, based on TriData studies, reported that “Call volumes in excess of 3,000 calls per year per apparatus is excessive” (Becker, 2009, p. 1) while under 500 was considered very low. His study is note worthy because he talks about firefighter fatigue related to call volume, finding that “Firefighters show great resistance to cognitive fatigue unless call volumes exceed 12 per shift” (Becker, 2009, p. 2). One method firefighters used to counter act fatigue was to take more time as they became fatigued. The study found working 24 hour shifts was not an issue and four member crews were thought to allow for compensation between tired crew members (Becker, 2009). One final note about call volume. PF&P study found one interesting finding, “there is no correlation between number of calls and repair cost for engine or truck companies” (TriData, 2006, p. 173). TriData recommended that PF&R not modify EMS response based on concerns regarding apparatus wear and tear.

While most people perceive EMS incidents as matters of life and death, the vast majority can be handled by Emergency Medical Technicians at the basic level (EMT-B) (Stout, Pepe, & Mosesso, 2000, p. 2). In fact the authors of the article observed “the value of using FR is recognized and strongly endorsed” (Stout et al., 2000, p. 4). A potential problem identified by the authors concerning ALS systems is most interesting, “Because paramedic-level (ALS) skills are required in less than 10% of emergency 911 calls, individual paramedics in an all-ALS system may rarely get the opportunity to use such skills” (Stout et al., 2000, p. 5). A Springfield Fire Department study done in 2005 noted that they provide FR using fire apparatus but recommended they upgrade their current certification program to EMT-B “as an improvement in EMS service to the public”(Buracker, 2005, p. xiv)

Performance measures have been around in the fire service for awhile. They can serve as a quick comparison to other fire departments. One such study Four Years Later – A Second Needs Assessment of the U.S. Fire Service (U.S. Fire Administration [USFA], 2006) gives the following trend data from across the nation. Nationally, ninety percent of firefighters providing EMS in communities with populations between 100,000 to 249,999 are trained; the most common level of training being ALS but no department was fully ALS trained. While fire departments that offer only FR level account for only 4.2% of department in this population range. When we look at all incidents we see on a national level Rescue & EMS incidents account for 69.3% compared to fire incidents 4.1% of fire department incidents (Flynn, 2009, p. 8). Even with the increase in call volume related EMS firefighter injuries are still downward trending (TriData Corporation, 2005, p. 11).

## **Procedures**

During a two week period while attending the National Fire Academy, the Learning Resource Center (LRC) was used to research all related information found concerning fire based EMS. Once home web searches were carried out using Google's regular, U.S. government and scholar search engines to search for material regarding fire based EMS, EMS systems, standards & coverage for the fire service, pre-hospital care, best practice for FRs, fire department statistics, dispatching and first responder.

Historical WFD contracts with Local 1339 were reviewed to better understand past services offered and time frames. Personnel interviews were conducted with both Assistant Fire Chief Joseph McDermott and retired Deputy Chief Joseph Delbuono to better understand department history. Department Standard Operating Procedures and training bulletins were reviewed to discuss how WFD delivers EMS currently. Chief Mike Brown, Executive Director Washington State Association of Fire Chiefs, was recommended by the IAFC for help on NFPA 1221 and 1710. Chief Brown who currently serves on NFPA Technical Committees confirmed that NFPA 1710 response times apply to emergency incidents as defined in NFPA 1710 and further established by the authority having jurisdiction (personal communication, October 19, 2010).

Dr. Lori Moore-Merrell, Assistant to the General President, International Association of Fire Fighters (IAFF) was contacted to answer questions regarding EMS Field Experiments study and NFPA 1710. Dr Moore-Merrell (personal communication, October 19, 2010) noted that NFPA 1710 addresses operational deployment for both BLS and ALS. It was further noted that AHJs should use trained EMDs and the MPDS to determine ALS and BLS level emergencies and non-emergencies. WFD dispatch center employs certified EMDs using a MPDS to dispatch

units and the AHJ has determined the criteria for a non-emergency or BLS level incident (Rinko, 2009)

In regard to the EMS Field experiments conducted by NIST et. al. (2010), crew configurations studied included both ALS and BLS trained personnel. All crews used in the study had firefighters trained to at least the EMT-Basic level which is a higher skill set than WFD current MRT (Waterbury Fire Department [WFD], 2009). After talking to Dr Moore-Merrell (personal communication, October 22, 2010) further limitation in the study was that the experiments only considered ALS level emergency events. Therefore, all response times were established according to the ALS level criteria in NFPA 1710.

A survey was developed to see what alternative systems were used other department to deliver FR services. The eleven departments used in the WFD TriData report (See Table 1) were contacted by phone and questioned on their current EMS system. The answers were manually entered into Survey Monkey then filters were used to look at the data by different groups, such as TriData comparison departments.

Table 1

TriData comparable fire departments

Alexandria, VA	Manchester, NH	New Haven, CT
Bellevue, WA	Edison, NJ	Hartford, CT
Anne Arbor, MI	Lowell, MA	Bridgeport, CT
Syracuse, NY	Stamford, CT	

The same survey then was sent out using email contacts and posted to fire service Facebook pages. One hundred percent of comparable fire departments used in the TriData (2004) report were interviewed and additional 13 departments answered the online survey.



WFD uses FireHouse software for incident reports. Reports were prepared relating to unit incident count, incident types, injuries and mileage. The FireHouse reports used were regular prepackaged reports and custom reports made by the author who is the system administrator for WFD. Data related to mileage was found to contain errors related to data entering; as such it was imported into excel for review. When review data out of sequence or suspect was removed. An example would be mileage that was out of sequence, such as lower than the previous day or higher than the following day. Incident times were also found to have issues, unit response times were consistently entered wrong into the computer aided dispatch (CAD) by dispatchers. Due to the quantity and quality of data, involved response times could not be filtered as the mileage data had been. As an example data entry issues were found with Rescue's 9 average response time, this company had one incident of a reported response time of 3118:38:1 on incident 10-0007702. The design of the CAD system makes it impossible to accurately look at call handling times before August 2010. As of the writing of this paper proper analysis of dispatch times was still not feasible because reports were still being validated. Susan Webster, Executive Director, of Northwest CT Public Safety was contacted by Adam Rinko for response times by the private ambulance services in Waterbury for cardiac arrest incidents (A. Rinko, personal communication, August 10, 2010). The times sent showed a high average response time that was not deemed credible by the author and could not be verified using WFD CAD system, as such they were not included in the report.

The worker compensation provider for WFD Berkley Administrators of Connecticut, Inc. (Berkley) was contacted for information related to injury rates for firefighters and civilians. Berkley was able to provide information in a spread sheet format, pertaining to the injuries of both firefighters and civilians. Summary reports were used with any identifying employee

information removed by Berkley. Mr. Frobel, a risk management consultant with Berkley, provided the injury rate for firefighters (C. Frobel, personal communication, August 19, 2010). Mr. Frobel noted that loss time numbers might be lower since the WFD offers alternative work assignments so injured employees can return to work with restrictions. Mary Ann Moody of Berkley provided the civilian injury rate caused by WFD apparatus movement (M. Moody, personal communication, October 15, 2010).

SurveyMonkey was used to survey current WFD members assigned to the operation bureau on their feelings on EMS. All on duty officers were sent a link by department email during their shift, a total of 47 emails were sent out with 32 completing the survey for a response rate of 68%. This survey was sent to on duty members using department email accounts, which limited the survey to officers and acting officers.

One factor that could have had an impact on minimizing the effects of EMS was a change in working hours when EMS was implemented. The department moved to a 42 hour work week using a 24 hours on, 72 hour off schedule. The previous work week was a 50 hour on a kelly day system, 24 hours on, 24 hours off, 24 hours on, 24 hours off, 24 hours on, 96 hours off. This schedule was disliked by the membership and seen by the members as political punishment by the state oversight board. While this was not within the scope of the paper the new schedule is seen by the members as a huge improvement in working conditions, as such it could have enough of a positive effect to help reduce effects of the added work load due to EMS.

### **Results**

WFD provides FR services with members certified to MRT as the Primary Service Area Responder licensed by the department of public health (Waterbury Fire Department [WFD], 2009, p. 1). According to WFD EMS instructor Rinko, MRT certification requires 50 hours of

training compared to EMT-B certification that is over a 130 hours (A. Rinko, personal communication, August, 2010). Members holding higher certifications are only allowed to practice at a MRT level (Waterbury Fire Department [WFD], 2009, p. 1).

WFD (2009) does use MPDS to determine response level of lights/siren or no lights/siren per its EMS operations procedure. This is also covered in WFD dispatch procedures, MPDS is used for all medical calls to provide “pre-arrival instruction and priority dispatch determinant codes” (Waterbury Fire Department [WFD], 2008, p. 1). Currently only Alpha determinant calls are dispatched with a no lights and siren response (Rinko, 2009). WFD currently sends a minimum of 4 MRTs to all dispatched EMS incidents using fire apparatus responding from existing fire stations (City of Waterbury & Local 1339, 2008, p. 19).

Because of limits discussed above, the evaluation of the department in regards to NFPA 1221 could not be complete. Research done on unit response found that WFD has increased its unit response approximately 222% (Firehouse (Version 7.5.60), 1993) in the 12 months following the rollout of EMS. Even with the increase in incidents WFD is meeting NFPA with 90.80% of emergency incidents having a unit on scene within 5 minutes (Firehouse (Version 7.5.60), 1993).

Table 2

Average response times by units

	<u>Reaction</u>	<u>Response</u>		<u>Reaction</u>	<u>Response</u>
Engine 1	00:01:06	00:04:19	Engine 6	00:00:57	00:03:43
Engine 2	00:00:47	00:03:15	Engine 8	00:00:54	00:04:30
Engine 4	00:00:57	00:04:10	Engine 11	00:00:57	00:04:05
Engine 5	00:00:51	00:04:22	Truck 1	00:00:47	00:04:49

Truck 2	00:00:55	00:04:42
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Engine 7	00:00:56	00:03:42
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Table 1 shows average times for a twelve month period after WFD started EMS. WFD would seem to meet the NFPA standard for unit response times and training. When this is compared to Upson & Notarianni (2010) reported average mean of 80 seconds for fire and 60 seconds for EMS (Upson & Notarianni, 2010, p. 1) the combined average reaction times for both EMS and fire emergencies in Waterbury looks acceptable.

CPSE website only lists Hartford fire department (HFD) as currently completing the CPSE accreditation process and ten other comparable departments from TriData (2004) comparison are not listed, which includes the 3 other large Connecticut fire departments, makes it hard to do a complete comparison to an accredited department. During the course of surveying fire departments it was found that HFD used the same staffing and certification level while employing apparatus to respond to EMS incidents similarly to WFD.

As Clawson et al. (2009) pointed out fire department needs a good EMD system to prioritize 911 calls and give good pre arrival instructions; WFD uses MPDS to accomplish this function (WFD, 2008). An interesting observation is that only 50% of all departments surveyed use dispatch software to prioritize incidents, when only looking at TriData comparable departments the percentage improved to 63.6% (see Appendix A and B). When all fire departments were asked if they used different response levels when responding, 39.1% answered yes, compared to TriData fire departments with only 10% of departments answering yes. The remaining 90% of departments responded to all incidents with lights and sirens. A review of 21652 WFD incidents shows that 75% of the responses are sent with lights & sirens (Firehouse (Version 7.5.60), 1993).

The importance of quick response time is well documented for CVD, as previously discussed, for each minute following a heart attack is a decrease of 10% in survival (Atkins et al., 2001).

Table 3

WFD on-scene response time analysis for chest pain and cardiac arrest

<u>Minutes</u>	<u>Count</u>	<u>Percent</u>
<	70	8.44%
01	211	25.45%
02	228	27.50%
03	154	18.57%
04	71	8.56%
05	44	5.30%
06	23	2.77%
07 & over	28	3.41%

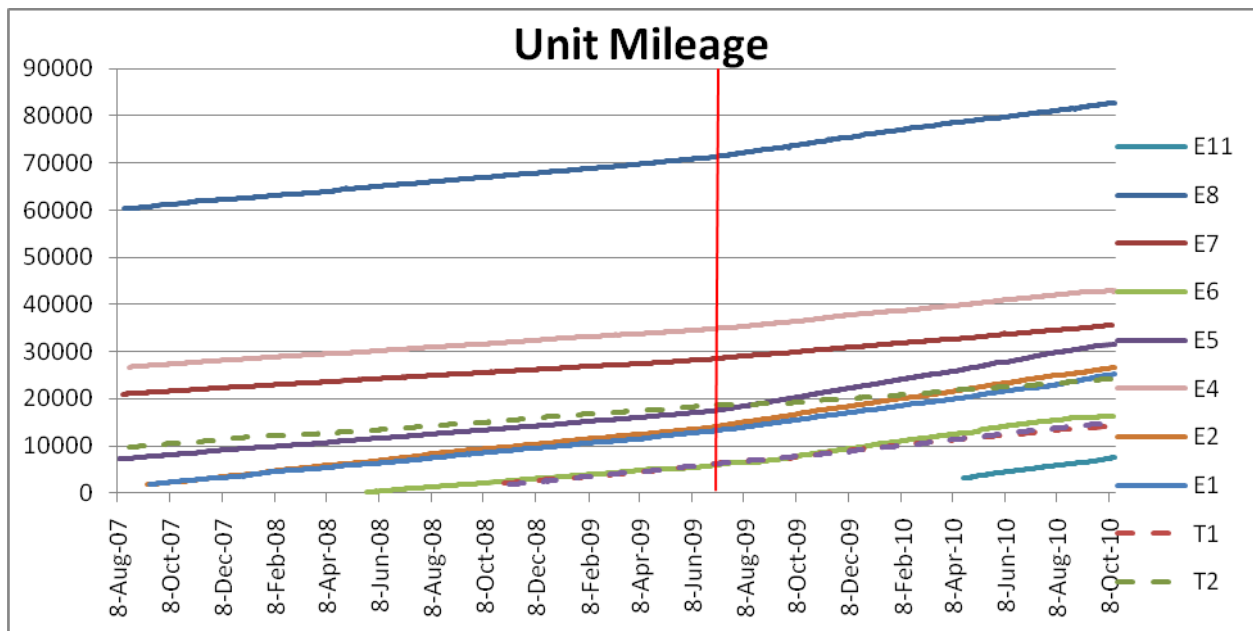
As Table 3 shows WFD has about 80% of units on scene within 3 minutes of dispatch for chest pain and cardiac arrest (Firehouse (Version 7.5.60), 1993). WFD is on scene 67.02% of times prior to EMS, 16.74% same time and only 16.23% of the EMS incidents show EMS units beating fire department units to the scene. WFD rate of 67.02% is comparable to PF&R 68.5% on scene prior to EMS which TriData found to be a vital link in their community EMS structure (TriData, 2006). This also supports both the stance by the Board on Health Care Service et al. (2007) that fire-based EMS can respond better than EMS agencies because of fire station disbursement and WFD's current use of existing fire station to respond to EMS.

High call volume has the potential to increase wear and tear on apparatus and members. As Dr. Becker (2009) discussed before, over 3000 calls a year can be excessive. Currently WFD only has one engine that exceeded that number; engine two had 3233 runs last between 7/2008 and 6/2009(Firehouse (Version 7.5.60), 1993). When WFD members were surveyed 51.5% consider 2000-3000 calls a year reasonable (Appendix C). When looking at alternative systems used by other fire departments that are comparable to WFD, there were some differences found as seen in Appendix A. When surveyed 90.9% used apparatus, one used SUV's and one department used utility trucks but still used apparatus as backup. The biggest difference between WFD and other department was in the use of prioritizing response level, 90% of the department's responded lights and siren to all incidents, whereas WFD used its MPDS to set response level for EMS incidents. WFD, as a non-transport agency was in keeping with the majority who answered they were also non-transport, 72.7%. The survey of TriData comparable fire departments found that 50% responded with 4 members, 40% sent 3 members and 20% responded with 2 members. The fact that one department had two different staffing levels caused the percentages to add up to 110%. As to level of certification, the survey found that departments were split, 45.5% FRs with AED and 54.5% EMT-B.

In order to analyze the impact of providing EMS on the Waterbury Fire Department, conclusions made in the TriData PF&R study must be addressed. TriData found that "there is no correlation between number of calls and repair cost" (TriData, 2006, p. 173), which is in keeping with an apparatus brake cost comparisons done by Administrative Officer Adam Rinko for Fire Chief Michael Maglione (A. Rinko, personal communication, October 6, 2010). Administrative Officer Rinko found there was no significant impact on apparatus due to additional EMS incident calls. As seen in Figure 1, the red line marks the beginning of EMS service for WFD. While

Figure 1

Unit mileage



there was a mileage increase of 60% (Firehouse (Version 7.5.60), 1993) on average for companies, during the same time those companies had 200% average increase in call volume. Administrative Officer Rinko noted an increase brake cost of 37% which was in keeping with the extra mileage but it accounted for only a 2.1% increase of the overall budget for the bureau.

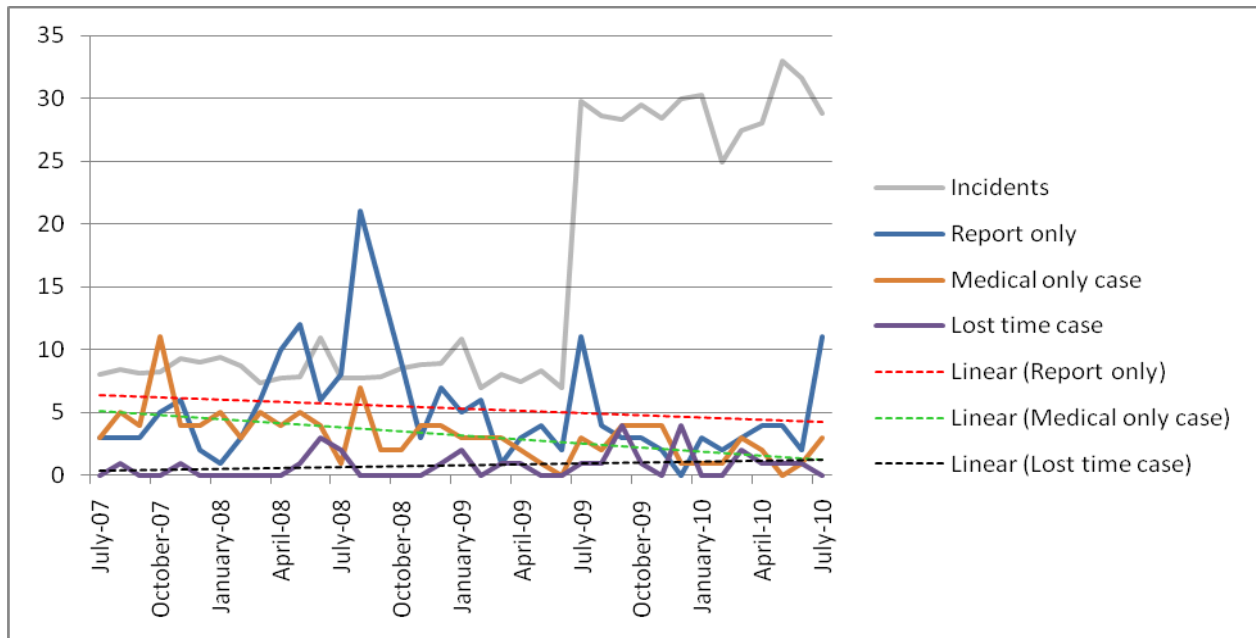
Reported injuries and doctor visits with no lost work time rates are trending down even with the increase call volume as seen on the next page in Figure 2 (C. Frobel, personal communication, August 19, 2010). While lost time cases have a slight trend up, there was no increase when WFD started EMS. Overall it is in keeping with the TriData report on The Economic Consequences of Firefighter Injuries and Their Prevention (2004) that EMS calls have lower injury rates than fire calls, such as working fires.

Given the finding by Dr. Becker (2009) members were surveyed on how long it took them to feel rested after working a shift. The majority of Waterbury firefighters reported they

felt rested after one good night's sleep at home (Appendix C). Some other interesting results were 96.9% of members feel WFD should be providing first response and 76.5% feel the department should train members to a higher level of certification.

Figure 2

Injury occurrences



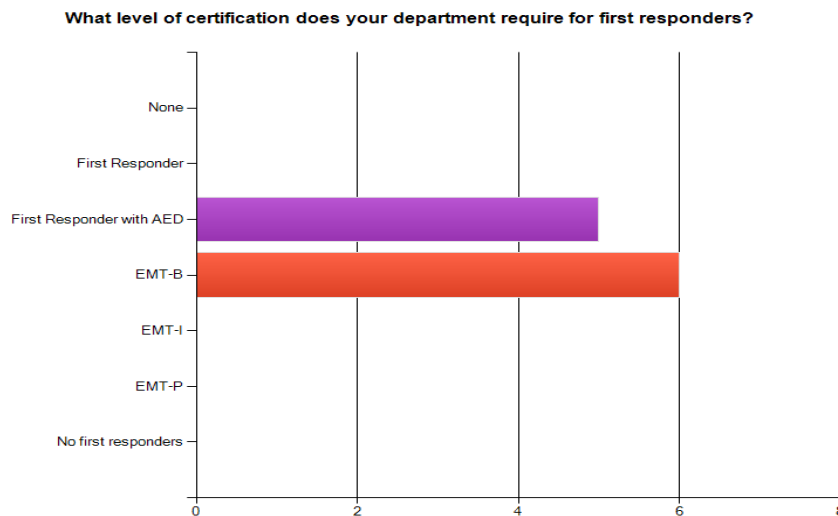
### Discussion/Implications

The current system of delivering EMS in regards to response time of units is effective, but the level of that service has been found below comparable departments. Response times have not suffered due to the increase in call volume, WFD meets NFPA 1710 with 90.80% of our units on scene within 5 minutes (Firehouse (Version 7.5.60), 1993), the problem found with CAD data prevent analyzes in regards to NFPA 1221. National 94% of department providing EMS in the 100,000 to 249,999 range held higher certification (Flynn, 2009, p. 32). Looking at comparable TriData fire departments, 54.5% were at a higher certification and the NIST et al. (2010) study only used EMT-B and above.



Figure 3

## Question 2 Fire Department based EMS



As to dispatch, WFD appears to be ahead of other comparable department in the use of MPDS to decide between light/siren and no lights/siren response. As seen in appendix A, 90% of department use light & sirens for all dispatched calls. By prioritizing calls and giving the proper response level, WFD can hopefully further decrease the chance of an apparatus crash which “while fairly rare, can be catastrophic, largely because of the size and weight of fire apparatus” (Craig et al., 2010, p. 109). WFD has done well in avoiding accidents involving civilians; the last one was in fiscal 2003-2004 (M. Moody, personal communication, October 15, 2010), given that civilians are “2.5 times as likely to be killed and four times as likely to be injured” (Craig et al., 2010, p. 113) by fire apparatus. 75% of WFD incidents were dispatched as a lights and siren response (Firehouse (Version 7.5.60), 1993) which Craig, Verbeek, & Schwartz (2010) contend departments could be over using.

Accreditation could offer WFD the ability to explain the need for resources based on proper risk assessment instead of service demand (Ludwig, 2009). As TriData (2004) noted in their study of WFD “while risks in the community are high...the actual fire activity is relatively

low” (TriData, 2004, para. 106). Mr. Barbieri said it best, “When a department becomes accredited it makes a statement about the organization meeting the “best practice” model for the fire service” (Barbieri, III, 2009, p. 47).

When reviewing comparable fire departments there seems to be little in the way of major differences in the delivery EMS. Looking at appendix A, 90% of the department surveyed use fire apparatus to respond to EMS incidents. Six departments’ comparable departments send FR crews of less than four but when looking at all departments in appendix B 60.9% of departments use less than four member FR crews. As seen by the answer to question two in both appendix A & B the majority of department’s FR are EMT-B. Response times have not suffered, WFD meets NFPA 1710 with 90.80% of WFD units on scene within 5 minutes (Firehouse (Version 7.5.60), 1993). WFD can do more as shown by Eisenberg & White (2009) when looking at why communities had such differences in survival rate for out of hospital cardiac arrest. Eisenberg & White (2009) thought that speed in the application of the American Hearts Association chain of survival could play a large part in the disparity. King County’s survival rate exceeds 50% and AED’s are used in 8% of the calls before the fire department arrives (Eisenberg & White, 2009, p. 259).

Evidence supports TriData’s (2006) PF&R finding that call volume is not related enough to repair cost to justify not sending apparatus on EMS incidents. But it should be noted the WFD does not have enough historical data on the effect of high mileage on life expectancy of the apparatus, nor did TriData (2006) speak to that issue in the PF&R Study. TriData (2004) did give some guidance in the WFD study when they classify most apparatus as “light to moderate use” (TriData, 2004, p. 221) in 2004. WFD increasing incidents from 3726 (TriData, 2004, p. 115) to 17497 last fiscal year (Firehouse (Version 7.5.60), 1993) could move WFD into the

heavy use category. If so, this would mean a change from a 12-15 years of use before replacement to 10-12 years for engines, roughly a 20% reduction in life expectancy of engines (TriData, 2004, p. 220).

The effect on the members of WFD seem as a whole to be positive, 87.9% (Appendix C) of members feel that EMS service has improved by the fire department providing FR. While 2009 was a year of change in the department, going from 4914 incidents the year before EMS to 17495 incidents the first year of EMS (Firehouse (Version 7.5.60), 1993), with an increase of about 3.5 times in incidents there has been no noticeable negative impact on operation or department morale. As shown injury rates are still trending down and lost time showed no discernable increase when EMS started (Figure 2).

### **Recommendations**

Based on my literature review and research I make the following recommendation to be considered for implementation by the WFD:

- 1) Implement a training program with the end result of training WFD members to EMT-B in keeping with national trends.
- 2) Form a committee to address out-of-hospital cardiac arrest survival rate as it is within are ability to improve survival rates by doing the following:
  - a. Study Seattle; Rochester, MN; King County to learn how they obtained 46% survival rates for out-of-hospital cardiac arrest.
  - b. Look into the fire department providing CPR/AED classes for the public to increase the survival rates for heart attack victim.
  - c. The communication center should start tracking the following times to add in data keeping:

- i. Time stamps for arrived patient
    - ii. CPR started
    - iii. AED shock delivered
    - iv. Ambulance crew arrived at patient
  - d. Study AED effect's on out-of-hospital cardiac arrest survival rate
- 3) Meet with local medical control and private ambulance companies to review current MPDS determinants codes response levels to ensure they are proper.

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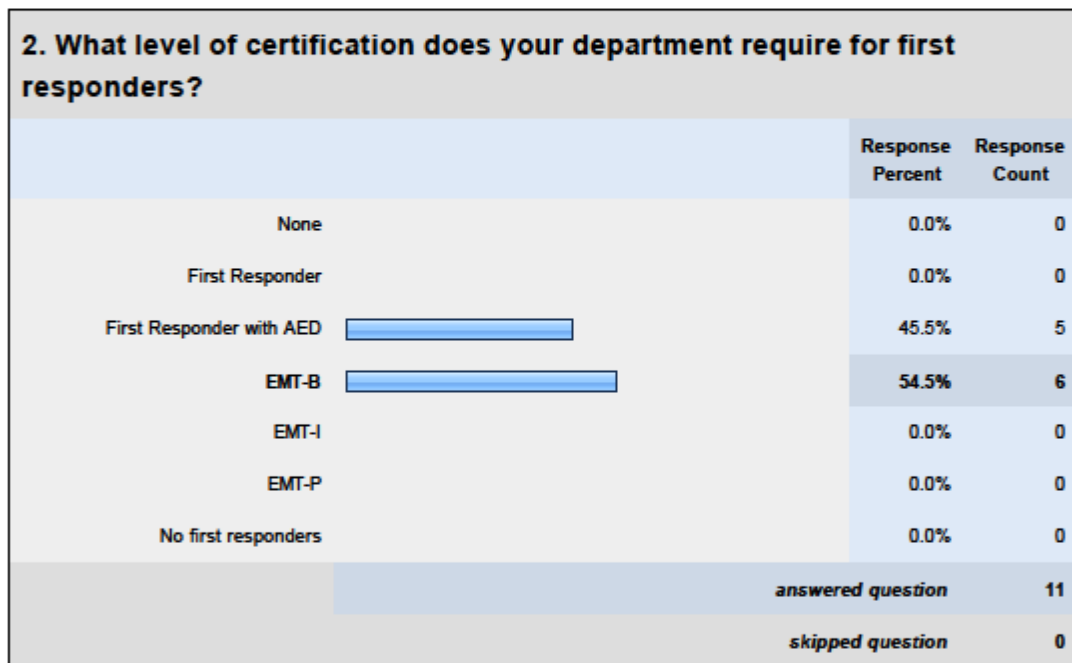
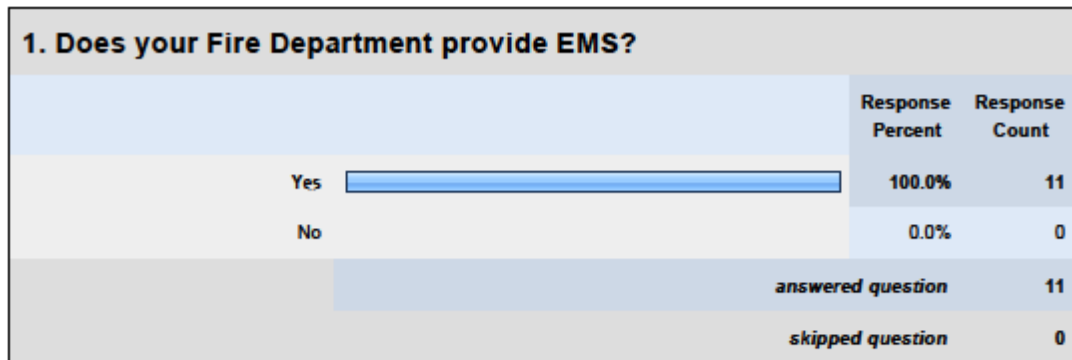
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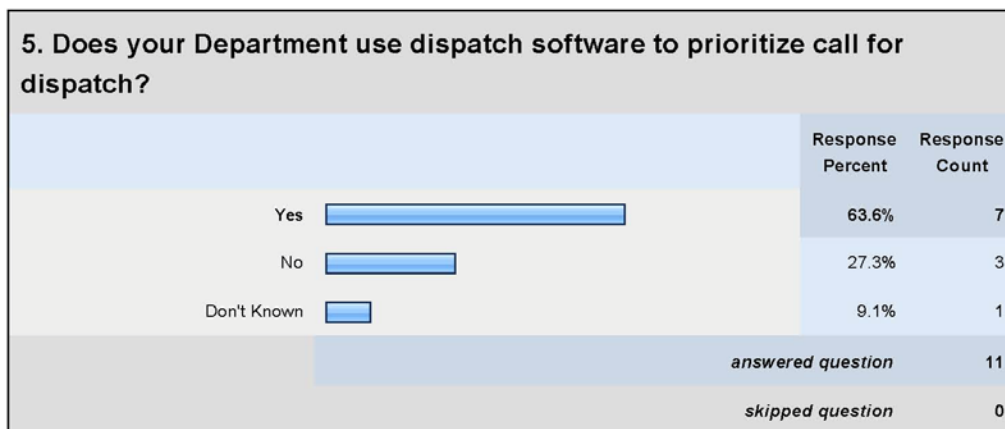
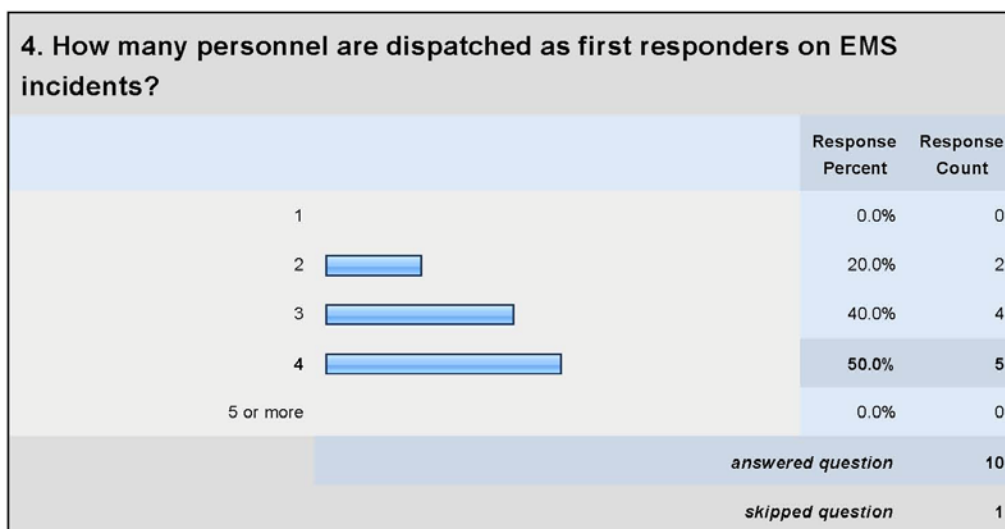
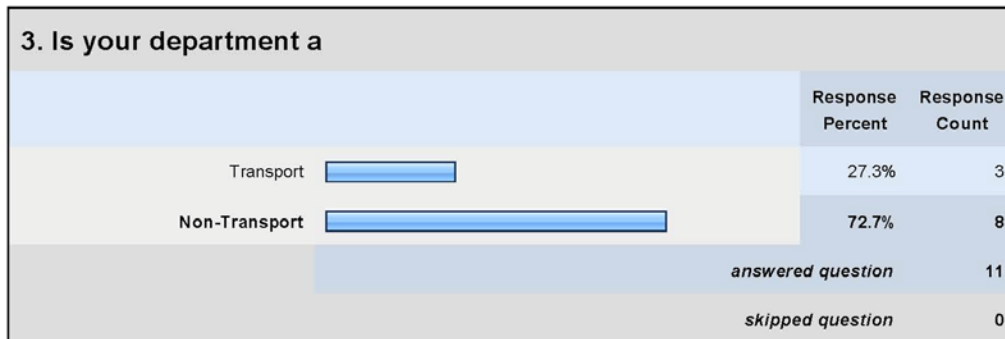
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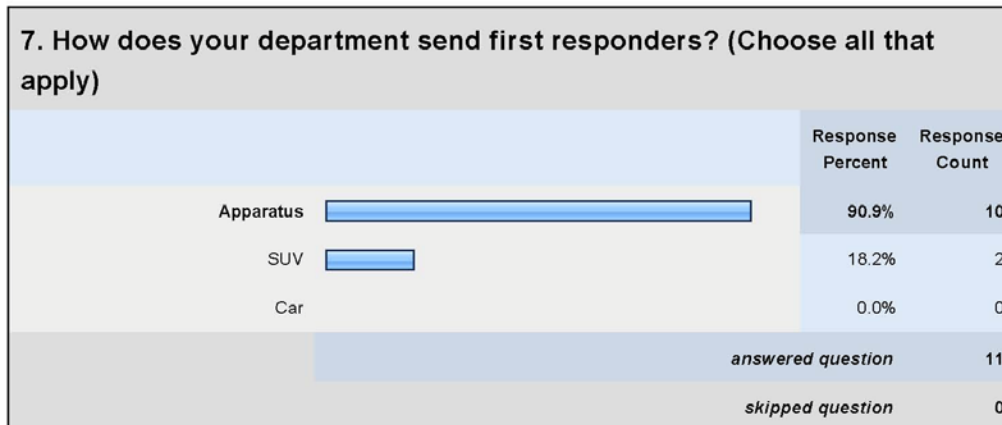
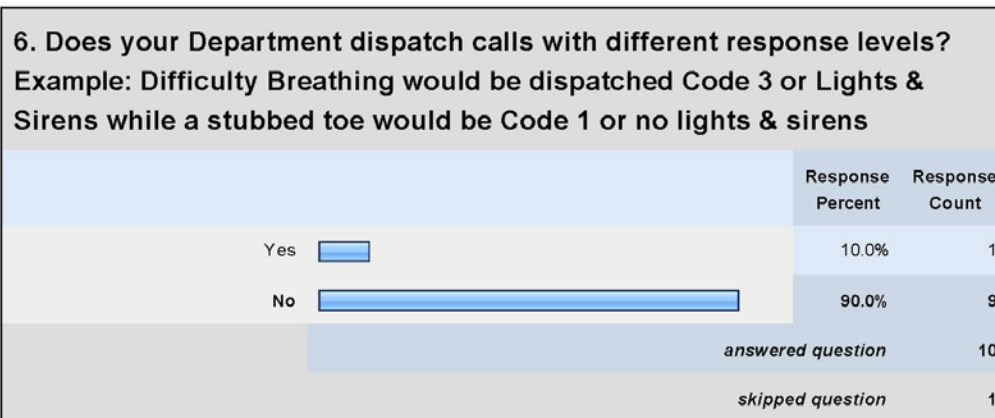
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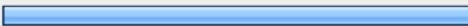
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## Appendix A

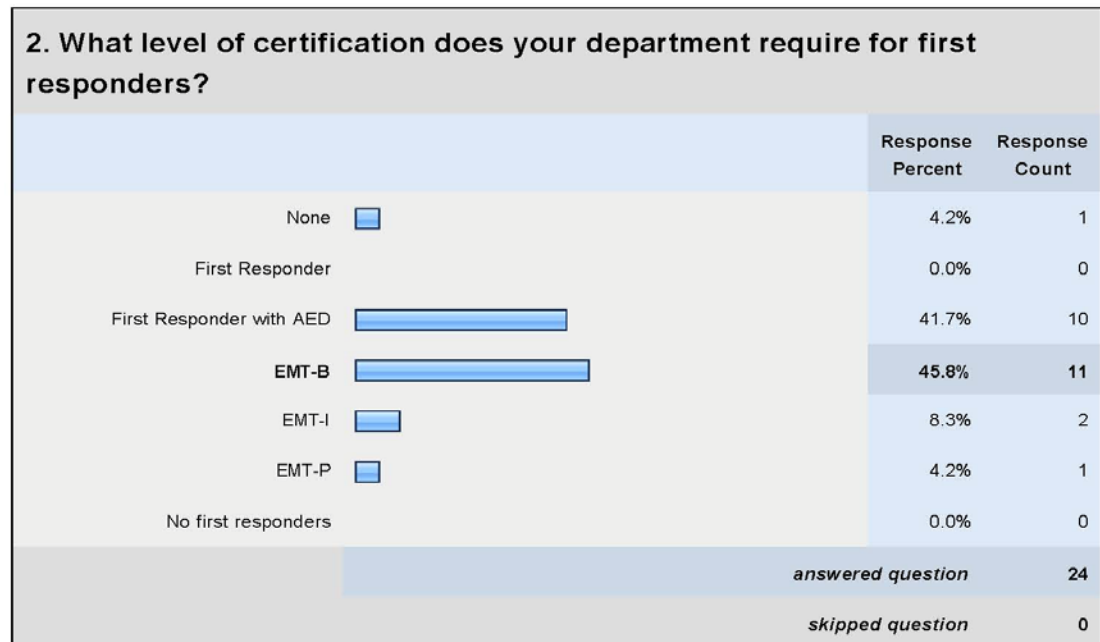
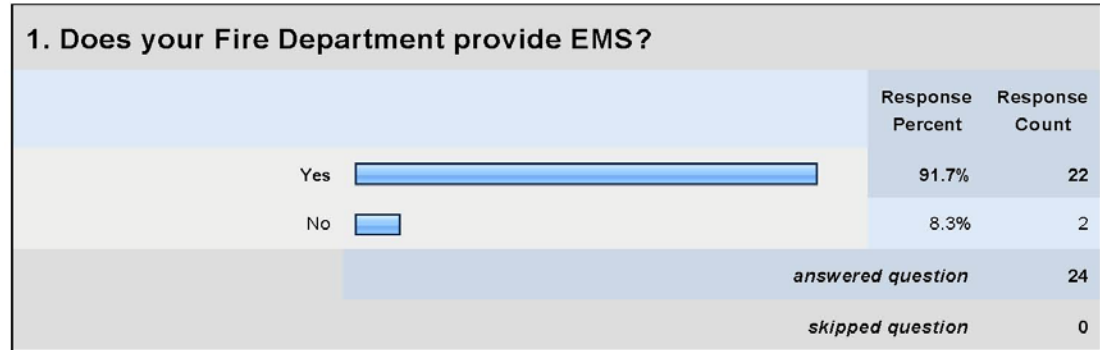
**Fire Department based EMS**



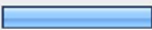
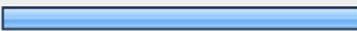


8. To better analyze the responses please provide the following information:		
	Response Percent	Response Count
Department Size 	81.8%	9
City/Town: 	100.0%	11
State: 	100.0%	11
ZIP:	0.0%	0
Email Address:	0.0%	0
answered question		11
skipped question		0





## Appendix B

**Fire Department based EMS**




**3. Is your department a**

	Response Percent	Response Count
Transport 	29.2%	7
Non-Transport 	70.8%	17
<i>answered question</i>		24
<i>skipped question</i>		0


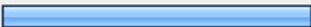
**4. How many personnel are dispatched as first responders on EMS incidents?**

	Response Percent	Response Count
1	0.0%	0
2 	26.1%	6
3 	34.8%	8
4 	34.8%	8
5 or more 	8.7%	2
<i>answered question</i>		23
<i>skipped question</i>		1

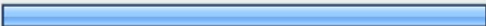


**5. Does your Department use dispatch software to prioritize call for dispatch?**

	Response Percent	Response Count
Yes 	50.0%	12
No 	41.7%	10
Don't Known 	8.3%	2
<i>answered question</i>		24
<i>skipped question</i>		0


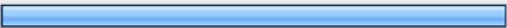
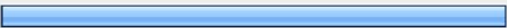
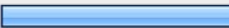

**6. Does your Department dispatch calls with different response levels?**  
**Example: Difficulty Breathing would be dispatched Code 3 or Lights & Sirens while a stubbed toe would be Code 1 or no lights & sirens**

	Response Percent	Response Count
Yes 	39.1%	9
No 	60.9%	14
<i>answered question</i>		23
<i>skipped question</i>		1

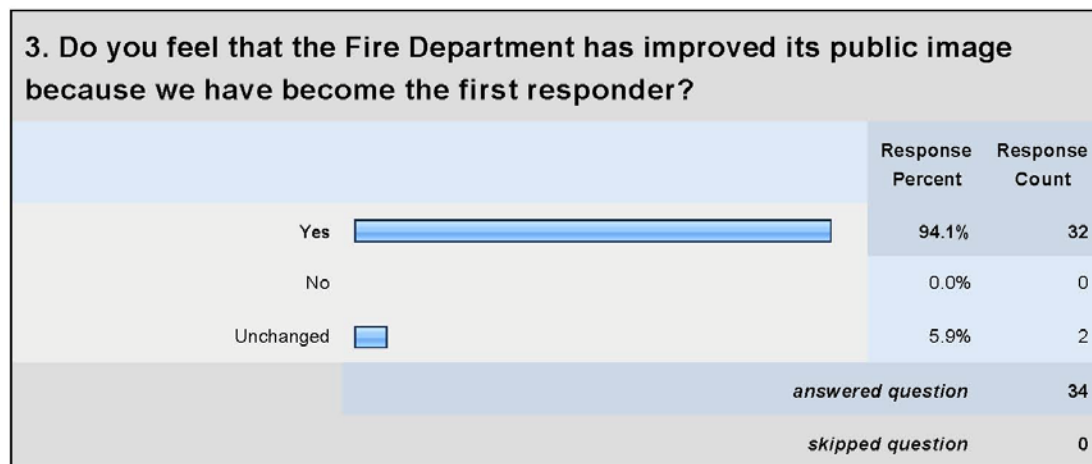
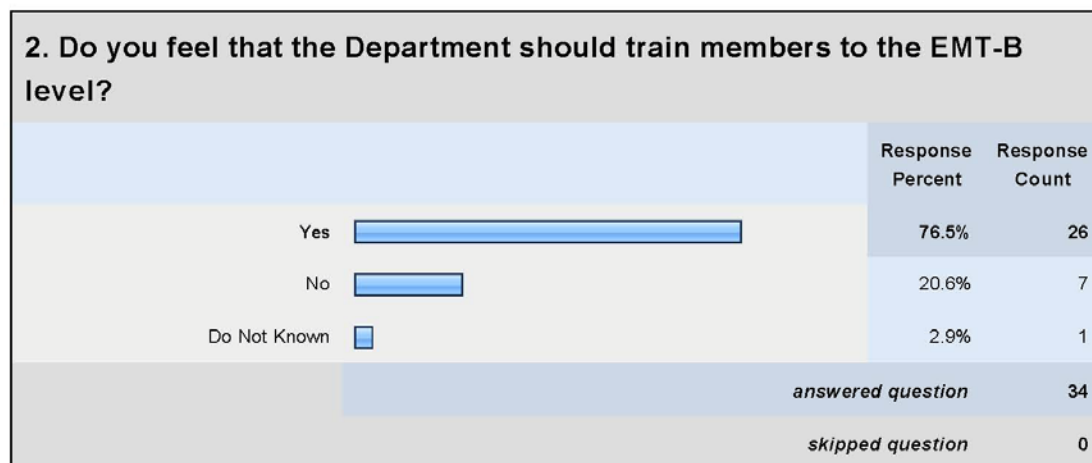
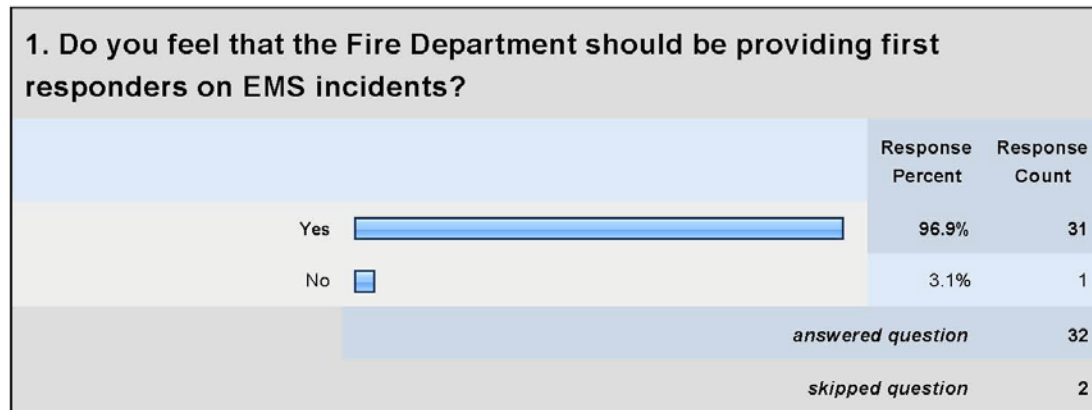
**7. How does your department send first responders? (Choose all that apply)**

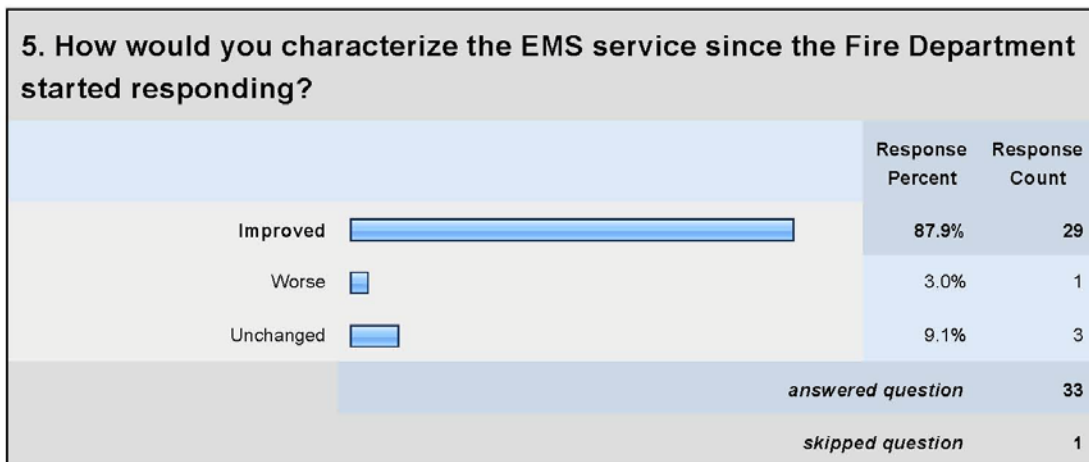
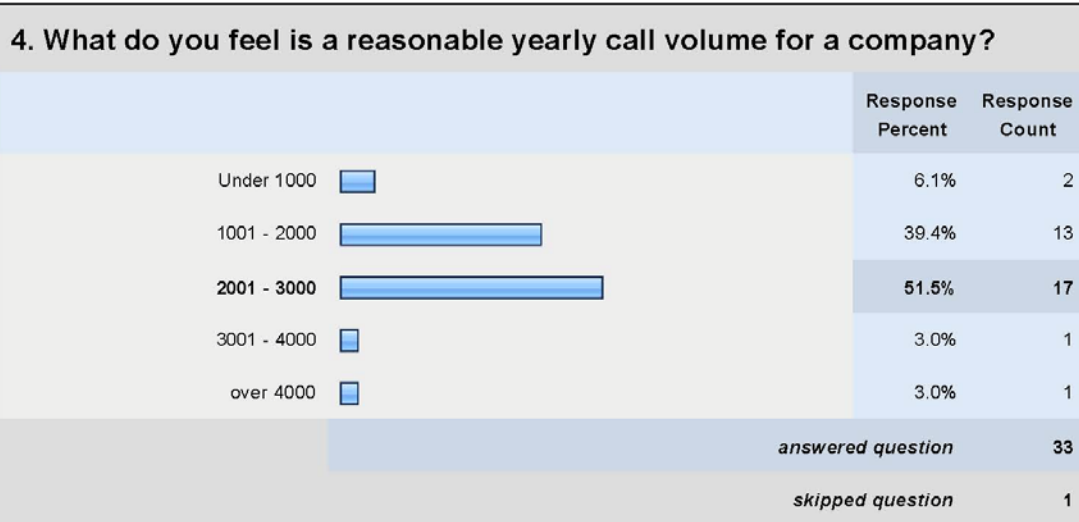
	Response Percent	Response Count
Apparatus 	95.8%	23
SUV 	20.8%	5
Car 	4.2%	1
<i>answered question</i>		24
<i>skipped question</i>		0




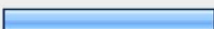
8. To better analyze the responses please provide the following information:		
	Response Percent	Response Count
Department Size 	90.9%	20
City/Town: 	100.0%	22
State: 	100.0%	22
ZIP: 	45.5%	10
Email Address: 	45.5%	10
answered question		22
skipped question		2

## Appendix C

**EMS survey for WFD members**





**6. Answer ONLY if you are a MRT: Do you feel more in-depth training in patient assessment would be helpful in your treatment of patients?**

		Response Percent	Response Count
Yes		58.3%	14
No		41.7%	10
<i>answered question</i>			24
<i>skipped question</i>			10

**7. How long does it take you to feel rested after working 24 hours with your full 72 hours off?**

	Feel rested in the morning	One good night sleep at home	Two good nights sleep at home	Three good nights sleep at home	Response Count
Slow night	37.5% (12)	53.1% (17)	9.4% (3)	0.0% (0)	32
Average night	3.0% (1)	66.7% (22)	30.3% (10)	0.0% (0)	33
Busy Night	0.0% (0)	47.1% (16)	41.2% (14)	11.8% (4)	34
<i>answered question</i>					34
<i>skipped question</i>					0

**8. Do you feel that WFD has to provide EMS to justify it's current level of resources?**

		Response Percent	Response Count
Yes		66.7%	22
No		33.3%	11
<i>answered question</i>			33
<i>skipped question</i>			1